MINISTRY OF TRANSPORTATION

RoadTalk

Ontario's Transportation Technology Transfer Digest • Winter 2007 • Vol 13 Issue 1

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Technology Transfer is a communication process by which information, regarding an improvement in a product or method, is exchanged and implementation into practice is facilitated.

Ontario

An additional evaluation was conducted with the Viking Two Stage blade in Guelph. Known as the double-bladed plow, the experimental model consists of a standard front steel blade with a smaller trailing blade (Figure 3). The trailing blade, which is independent and hydraulically controlled, has flexible segments designed to clean off loose snow scraped up by the leading blade, and to clear slush that a conventional blade cannot reach. Manufacturers Viking-Cives Group claim the second blade reduces the need for multiple passes and road maintenance (such as salt or sand) thereby achieving significant savings. The flexible design of the second blade also provides efficient plowing of rutted or frost heaved pavement. Further tests to compare the standard blade to the dual blade are planned for winter 2006/07. A formal comparison will determine whether the technology will reduce salt use, blade wear and overall costs.

MTO will also examine the use of Viking Cive Group's multi-plow trailer, an innovative design developed for use on wide airport runways (Figure 4). Two or more plows fan out from a single vehicle to plow two or more lanes at the same time. This may reduce equipment and operating costs required for a conventional plow convoy operation on multi-lane highways. Future MTO evaluations will determine whether the multi-plow trailer can operate effectively on freeways with ramp lanes, heavy traffic and other complicated features.●

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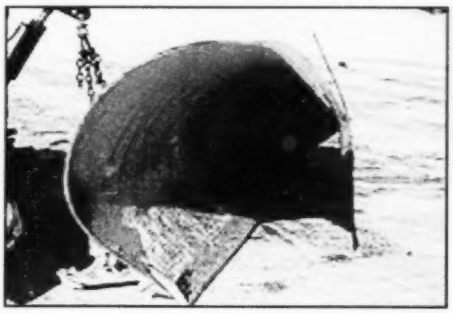


Figure 1. Standard steel blade composed of a straight steel piece attached to the bottom of plow

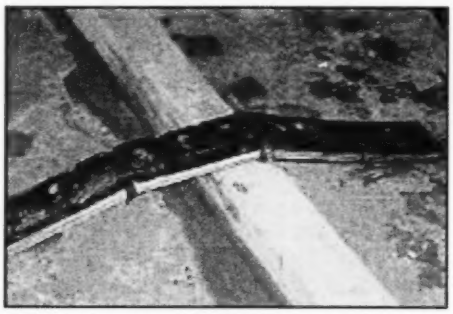


Figure 2. The Joma blade 's flexibility, attributed to rubber mounted steel segments, is demonstrated over a plank

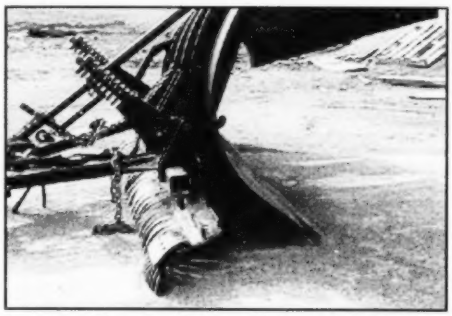


Figure 3. Viking Double Plow blade (side) is formed by a standard blade and trailing sweepers

Figure 4. Viking trailer with multiple plows

Passe -à- Fontaine

Pre-fabs to span Ontario bridge construction

MTO, in partnership with an Ontario contractor - Leo Alarie and Sons Limited, successfully used prefabricated bridge technology to save time and money. Pre-cast full roadway depth/width concrete slabs were used for the Passe-à-Fontaine Bridge approximately 20 km northwest of the Town of Hearst. Savings from adopting the proposal reached nearly $30,000.

Crossing the French Creek at the Hanlan Narrows, the original bridge was a 36.5 metre single-span Bailey bridge. To avoid in-water construction and disruption of a sensitive pickerel habitat, the new bridge abutments were constructed within the existing bridge approach and a Retained Soil System (RSS) wall.

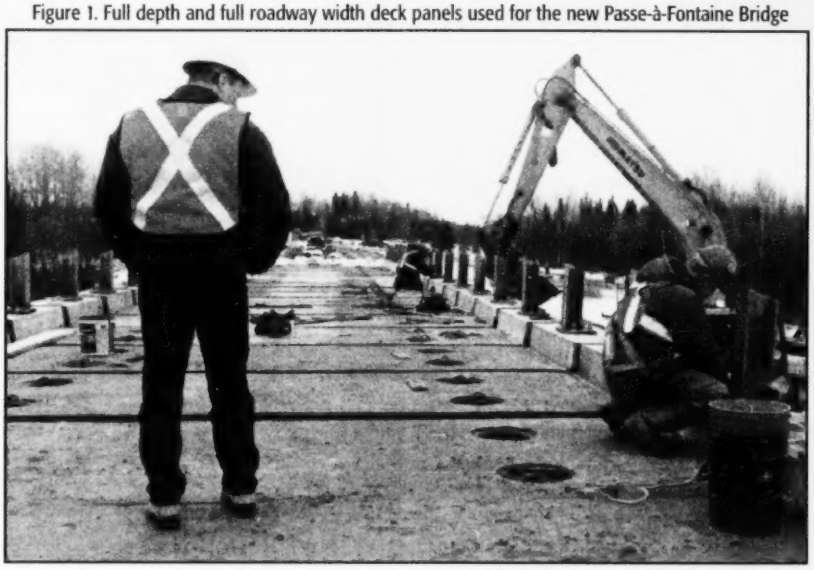
The tendered design for the replacement bridge was a single lane, single-span steel girder bridge and featured an exposed concrete deck and semi-integral abutments founded directly on bedrock. The contractor's change proposal for a precast full roadway depth/width deck with a foundation on bored mini piles embedded in the bedrock was approved by MTO after a comprehensive review.

During construction the existing Bailey bridge and substructure were removed, the road grade was raised to provide structural, navigational and hydraulic clearances, and a new temporary single-lane structure was installed. The full roadway depth/width panels were fabricated and transported on flat bed trailers without the need for oversized load permits. A Cat 970 Loader placed the panels on steel girders and, once sheer bolts were installed, cast-in-place closure strips were poured. Overall quality is improved when concrete is placed in a controlled environment, under optimal conditions and under strict quality assurance standards. Using this prefab system cut six months from the construction schedule and with further industry experience, is expected to have even greater efficiencies.

"We're glad to see a contractor proposing innovative methods to reduce on-site construction time," says Alain Beaulieu, coordinator for MTO's Prefabricated Bridge Systems Implementation Team. "This technology can reduce on-site construction time, resulting in reduced worker exposure to live traffic." MTO has since included prefabricated bridge technology in several projects to promote industry knowledge and experience.●

For more information, please contact Alain Beaulieu, P.Eng., Co-ordinator, Prefabricated Bridge Systems Implementation Team at (905) 704-2956 or at Alain.Beaulieu@Ontario.ca

Figure 1. Full depth and full roadway width deck panels used for the new Passe-à-Fontaine Bridge



"This technology has the potential to reduce on-site construction time, resulting in reduced worker exposure to live traffic."

-Alain Beaulieau
Co-ordinator,
Prefabricated Bridge Systems
Implementation Team

For more information about Prefabricated Bridge technology visit:
http://www.fhwa.dot.gov/bridge/prefab/index.htm

Soil Consolidating Technology

Wick Drains Used for HWY Swamps

Growth in commuter and recreational use in this corridor has prompted MTO to expand Highway 69. A strategic link in the Trans-Canada Highway System, the existing two-lane roadway serves to connect northern and southern population centres. One segment of the Highway 69 expansion project is the four laning from Highway 537, northerly for a distance of 8.8 km. This stretch of Highway 69 involves a number of swamp crossings that requires the design and construction of embankments, some as high as 26 metres over weak compressible clay soils. The application of wick drain technology, or Prefabricated Vertical Drains (PVDs), was chosen as a cost effective alternative to the conventional procedure of excavation and backfilling or commonly termed as "dig outs". The wick drain design methodology is part of a "floatation" design approach that leaves the compressible soils in the ground. This saves considerable time and expense in the excavation and removal of the native soil material and also in the time and material to backfill the excavation. The cost savings from installing wick drains at the 5 swamp sites amounted to approximately 25 million dollars.

November 2001
Road Talk Vol 7 Issue 4:
"Wick drains are prefabricated plastic cores wrapped in a geotextile cloth which draw water from the soil when pushed into the earth. Wick drains accelerate the settlement of road embankments."

Leaving the native soils in place also offer environmental advantages since disturbance to the natural environment is minimized and haulage and disposal is avoided.

The design includes the preloading and/or surcharging the embankment and the use of wick drains to accelerate the rate of settlement. Typically an additional temporary surcharge fill of 2 metres is placed at the top of the embankment that is removed once the embankment settlement is achieved.

Figure 2. Spools of wick drain pushed into the ground

Staged construction has been specified to prevent embankment failure during the construction of the embankments and a comprehensive geotechnical monitoring program has been designed to control the rate of construction and to monitor the performance of the embankments.

When an embankment is built on compressible soil, it can take several years before the embankment stops settling. Using wick drains reduces the settlement duration to weeks or months. Forcing soil consolidation to occur at the outset of the project and in the shortest possible time during construction is desired to avoid expensive construction problems and delays and also to improve post-construction performance of the roadway. On the Hwy 69 projects, the predicted rate of settlement without wick drains ranged from 2 to 5 years compared to 6 to 13 months with wicks.

The wick drain technology was chosen at 5 of a total 10 swamp locations within the project. Wicks were selected at the sites where the clay thicknesses exceeded 10 metres and where embankment heights exceeded 6 metres. Wicks were designed at a 1.5 m triangular grid pattern to depths ranging from 10 to 25 metres below orignal ground. (Figure 1) The total length of wick drains is 785,000 metres, approximately equivilent to a round trip between St. Catharines and Sudbury.

Figure 1. Grid patterned wick installation

Wick installation commenced in the summer of 2006 under Contract 2006-5150 awarded to Pioneer Construction and currently scheduled for completion in summer 2009. On this project wicks are being installed within a temporary steel rectangular casing that is pushed into the ground using a backhoe modified with a vertical lead. (Figure 2) The procedure is analogous to a sewing machine whereby a spool of wick drain is fed into the mandrel as the mandrel is pushed into the ground to the design depth.

The measurable success of wick drain technology on MTO projects has revolutionized the methodology of embankment construction over swamps. The advent of wick drain technology has resulted in more efficient construction methods, increased cost savings and minimal disturbance to the environment.

On this project, the development of the wick drain design illustrated a successful partnership between the Prime Consultant (URS Canada Inc), the Foundations Engineering subonsultant (Golders Associates), Northeastern Region Planning and Design and the Pavements & Foundations Section.●

For more info on Highway 69 Four Laning visit::
http://www.mto.gov.on.ca/english/traveller/highway69/

For more information, contact Tony Sangiuliano, Materials Engineering and Research Office, at (416) 235-5267 or Tony.Sangiuliano@ontario.ca.

Corrosion Inhibitors Test

MTO Test for Optimal Winter Inhibitors Level

MTO's corrosion inhibitor requirements for winter road maintenance liquids (WRML) are being re-evaluated using tests that measure their performance under real-world conditions.

Liquids were introduced to the snow and ice control program beginning in 2000 after tests confirmed that they improve the effectiveness of road salt and can result in an overall reduction in salt use. They are either applied directly to the pavement in advance of snowfall or are sprayed onto granular salt as it is spread during a storm. A requirement that liquids other than those made from rock salt include corrosion inhibiting additives was introduced when contractors expressed concern that the liquids might add to rusting of their vehicles. The requirement closely follows that of other industry groups such as the Pacific Northwest Snowfighters, specifying that they reduce corrosion levels substantially below that of rock salt solution under laboratory conditions. Since then contractors have requested exemptions from the corrosion inhibitor requirement in an effort to reduce costs.

MTO launched field tests in fall 2006 to provide guidance in setting cost-effective requirements for corrosion inhibitors. The tests will provide comparative data on corrosion levels occurring over a winter season on test coupons installed on trucks and roadside infrastructure in areas where different levels of inhibitor are used. The project was undertaken by MTO's Design and Contract Standards, Materials Engineering and Research Offices, Southwest Region and Eastern Region, with assistance from contractors Steed and Evans, and TWD Roads Management.

Corrosion coupons of specified steel and aluminum measuring 89.0 x 50.0 mm x 1.59 mm thick, were weighed, numbered and then suspended on threaded nylon rods. The rods were either bolted or wired to the frames of two combination plow-spreader trucks and one patrol vehicle (Figure 1), two steel guide rail posts, two sign-posts and an environmental control away from the highway in each test area. 560 coupons were installed in total.

The coupons are exposed to WRMLs with inhibitor levels of 0%, 50% and 70% less corrosive as compared to sodium chloride brine. The WRMLs include sodium chloride brine, magnesium chloride brine, and a multi-chloride brine containing sodium, calcium and magnesium. The coupons are exposed to all winter maintenance and environmental conditions that naturally occur in each field area and will provide a practical evaluation of the effectiveness of the inhibitors.

The coupons will remain mounted for the full winter season. They will be retrieved and re-weighed in Spring 2007 to determine the extent of corrosion occurring in each area and the optimal percentage of inhibitors to use in MTO contracts. Look to future issues of Road Talk for coverage of preliminary results.•

The use of DLA and Pre-wet complement the conventional practice of spreading granular sodium chloride salt during winter storms.

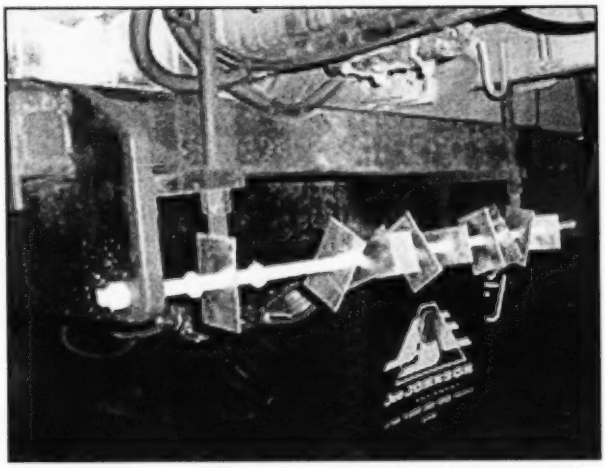


Figure 1. Coupons mounted under the body of winter maintenance vehicles

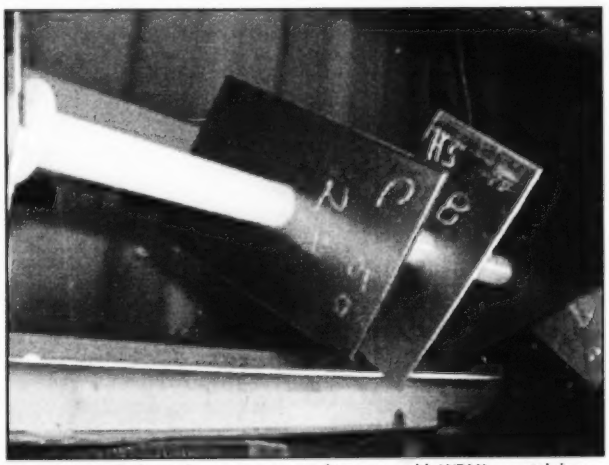


Figure 2. Detail of metal coupons exposed to areas with WRMLs containing different levels of corrosion inhibitors

For more information, contact Max Perchanok, Maintenance Office, at (905) 704-2638 or Max.Perchanok@ontario.ca

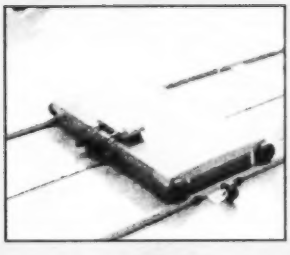
MIT-2 Scan Evaluated on Dowel Bars

Concrete Proof

In Ontario, concrete pavement design for heavily trafficked highways consists of doweled jointed plain concrete pavement (JPCP) over an open-graded drainage layer (OGDL) and granular base and sub-base. Epoxy coated, smooth, 456 x 32 mm steel dowel bars are placed at 300 mm centres across the transverse joints to provide load transfer. Longitudinal joints are tied with 15 x 760 mm tie bars spaced at 600 mm intervals.

In the past, the position and alignment of dowel bars within a concrete pavement was difficult to verify. MTO required that cut-outs 2m x full paver width be made to ensure that the placement and alignment of the dowel bars met contract requirements. This type of destructive verification was typically carried out only at the beginning of concrete placement and not repeated.

The Ministry of Transportation's Materials Engineering and Research Office has been performing an ongoing evaluation of the Magnetic Imaging Tomography (MIT) Scan-2 as a innovative non-destructive test for evaluating dowel bar alignment on concrete pavement contracts. This was facilitated through an equipment evaluation program established by the Federal Highways Association (FHWA), which loaned the MTO an MIT scan device in September – October 2006. The scan was used by MTO to train staff and to measure selected joints throughout southern Ontario on three concrete pavement highways. (Figure 1)



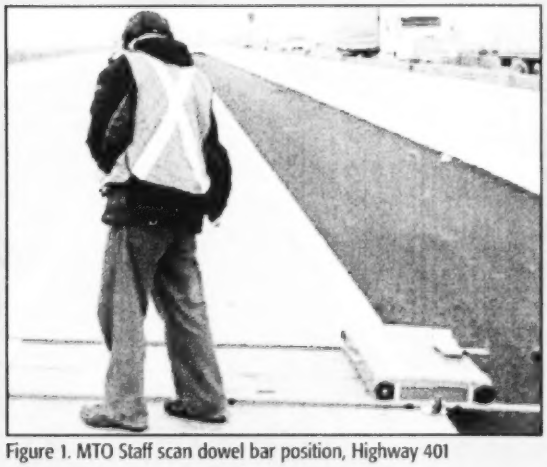


Figure 1. MTO Staff scan dowel bar position, Highway 401

The three highways evaluated were: Highway 417, Highway 404 and Highway 401. The pavement structure on Highway 417 consisted of 200 mm thick jointed plain concrete pavement (JPCP) with 456 x 32 mm dowel bars as load transfer devices. The dowel bars were inserted by a four-track slipform paver with a rear-mounted automatic dowel bar inserter (DBI). On Highway 404 the pavement consisted of 250 mm JPCP with 456 x 32 mm dowel bars. The dowel bars were placed using metal baskets secured to the granular base. Finally on Highway 401 the pavement structure consisted of 260 mm JPCP with 456 x 32 mm dowel bars. The dowel bars were inserted with a four-track paver with a centrally located dowel bar inserter.

A total of 8388 dowel bars were scanned over the three highways. After analysing the recorded data with the post processing software MagnaProof^{tm} many issues with poor dowel bar alignment such as: uncut transport ties, dowel bars intersecting tie bars and major side shift became evident, helping prove the usefulness and need for the MIT Scan-2 on all concrete pavement contracts. Actual use of the MIT scan and its post processing software has allowed the Ministry to conclude that the MIT Scan-2 can be used as a successful real time, non-destructive inspection tool. When used as Quality Control (QC) tool by the contractor, the MIT Scan-2 can help identify dowel bar alignment problems early in the paving operation and identifying rejectable dowel bars for repair.

The next step in implementing the MIT Scan-2 as a routine inspection tool on concrete paving contracts will be to convince industry of its usefulness and the validity of this technology as a QC/Quality Assurance (QA) tool.

When concrete pavements are designed correctly and constructed to specification, 30 years or more of service can be expected. Using the MIT Scan-2 to insure that all dowel bars are aligned properly provides another inspection tool to insure the MTO obtains the maximum life expectancy from this asset. Ultimately this technology will help reduce future costly repairs and allow the Ministry to allocate funding to other areas of need.

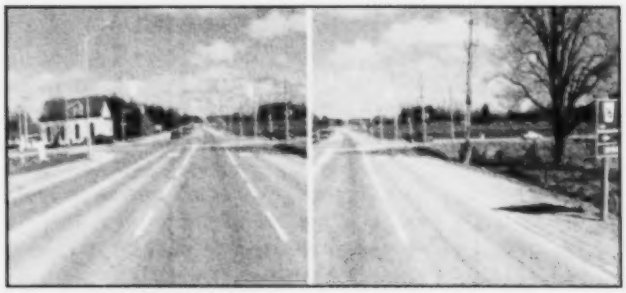
The Ministry is committed to this technology and will continue to evaluate the MIT Scan-2 to insure that it meets the ministry's needs.

For more information, contact Becca Lane, Pavements & Foundations Section, at (416) 235-3513 or

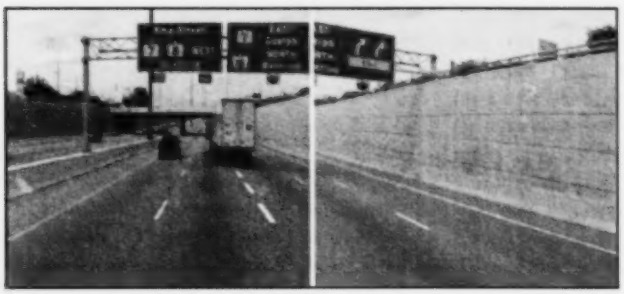
Video logging Demonstration

Digital Eye on the Road

The following article originally appeared in the May/June 2006 Southwestern Region Monthly Report and has been updated to reflect current findings.



Above & Below. Videologging image samples, taken at 5 metre intervals in both directions of all SWR highways. Photos can be saved to a user's computer



For more information, contact
Peter Godwin, Geomatics,
(519) 873-4397 or Peter.Godwin@ontario.ca

Video logging is the general term used to refer to the system of truck-mounted digital cameras, Global Positioning System (GPS) and Geographic Information System (GIS) technologies. Together, they provide geo-referenced images along highway corridors. Video logging enables MTO to view a highway through continuous images and extract, measure and catalogue highway assets; while the geo-referencing aspect of the data allows access from desktop GIS maps. Many road authorities are rapidly adopting the technology that allows an up to date look at features or elements of the highway.

In October 2005, MTO awarded Stantec Consulting Limited a consultant assignment managed by the Southwestern Region (SWR) Geomatics Section to complete a demonstration project. The assignment acquired video logging of MTO Highways in the Owen Sound area, Highway 402 and Highway 403 in SWR as well as Highway 7 from Stratford westerly. The purpose of the project was to assess the benefits of video logging and feature/asset extraction technology. This coincided with a similar project undertaken by Central Region Geomatics.

The assignment specified two cameras with colour, and geo-referenced digital images taken at 5 metre intervals in both directions of the highways. A total of approximately 1,840 kilometres of digital images (consisting of approximately 735,000 .jpg images) were delivered by the consulting firm and filed by MTO's Linear Highway Referencing System (LHRS) section number in order to ease the organization and GIS access to the data. When viewed in succession, the individual images create the sense of a moving video of the highway. Demonstrations of video logging resulted in positive feedback from Engineering, Contracts and Operational Services and concluded a variety of uses. The ability to view pavement conditions, entrances, signs and pavement markings would be beneficial to MTO's maintenance operations. In addition, access to information would assist with public inquiry, such as photos for report use or data for scoping projects.

The videologging demonstration project was completed on the remainder of SWR in mid-2006. Plans for further assessment of this technology as a roadway management and cataloguing tool has been planned by the ministry. ●

Upcoming Conference Information

2007 World of Asphalt Show & Conference
March 19-22, 2007
Atlanta, GA

Concrete Paving Association of Minnesota Annual Conference
March 15-16, 2007
St. Cloud, MN

15th Annual Roadway Management Conference
April 2-4, 2007
Charlottesville, VA

Association québécoise du transport et des routes- 42e congrès annuel
April 2-4, 2007
Montreal, QB

Washington Chapter APWA Spring Conference
April 9-12, 2007
Holiday Inn, Everett, WA

Minnesota Spring Maintenance Training Expo
April 10-11, 2007
St. Cloud, MN

Ontario Traffic Conference Transportation Planning Workshop
April 27, 2007
Niagara Falls, ON

Intelligent Transportation Systems Society of Canada - ITS Canada Annual Conference and General Meeting
April 29 - May 1, 2007
Niagara Falls, ON

Canadian Institute of Transportation Engineers 2007 Annual Conference
May 6-9, 2007
Toronto, Canada

Total Monitoring System

MTO's Intelligent Transportation Systems (ITS) program is developing an innovative system which tracks traffic conditions and visibility levels through wireless, solar powered communication. Known as the Total Monitoring System (TMS), it is the first of its kind in North America. While MTO currently makes use of the COMPASS system for road management in heavily travelled areas, TMS has wider potential in remote areas, recording not only traffic data and images as COMPASS does, but also local visibility levels. The system's ability to report weather conditions could aid the Ontario Provincial Police (OPP) to determine the need for road closures.

The combination of technologies holds promise for MTO's roadway management. TMS uses wireless communication to send and receive data and images. Powered by solar energy, the equipment promises the benefits of environmental friendliness, easy installation and Web accessibility. (Figure 1)

Figure 1. Solar panels are the power source for MTO's Total Monitoring System

MTO submitted the concept of TMS to the ENTERPRISE Group in 2004. The international ITS agencies voted the road management system best of the year, and sponsored a demonstration project on Ontario roads. The project gathered momentum, with support from individuals and organizations. The large team included expertise and funding from the ITS program, Southwestern Region (SWR) and Central Region, as well as equipment manufacturers and suppliers like Bell Canada.

TMS has been tested on Highway 21 in Kincardine with moderate success. The particular stretch of highway was chosen because of drifting snow and poor driver visibility in the area.

Acting ITS Head Ataur Bacchus said the refinements and user interface improvements to TMS will likely be pursued in winter 2007/08, potentially turning the demonstration project into an operational tool for the OPP, District and Regional staff as well as provide improved service to the travelling public.●

COMPASS is a freeway management system developed by MTO in response to urban traffic congestion in the GTA. Through closed circuit cameras, vehicle detector stations and maintenance patrol, information is relayed to the public via the Traffic Operations Centre.

For more information about Total Monitoring System, contact Ataur Bacchus, Intelligent Transportation Systems Program, at (416) 235-4673 or Ataur.Bacchus@ontario.ca

Reader Response

Send us any ideas, comments, or suggestions concerning local innovations, workshops, or seminars that you would like to see included in future issues.

Road Talk is also available in French.

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